

ENGLISHLRFDDESIGNEDSINGLECULVERTSFHW.DGN - FWH 15-9-21 51 - THIS SHEET ISSUED 02-2021.

Bill of Reinforcing for One Headwall 15° Skew Span x Culvert Height

Bar	Location	Shape	10' x 12'			10' x 11'			10' x 10'			10' x 9'			10' x 8'			10' x 7'			Bar		
			No.	Length	Wt.	No.	Length	Wt.	No.	Length	Wt.	No.	Length	Wt.	No.	Length	Wt.	No.	Length	Wt.			
5fa	Fence Anchor (Galv.)		2	2'-10"	6	2	2'-10"	6	2	2'-10"	6	2	2'-10"	6	2	2'-10"	6	2	2'-10"	6	5fa		
4b1	Wingwall, B.F.H, Long		1	45'-7"	32	1	42'-2"	30	1	38'-9"	26	1	35'-4"	24	1	31'-11"	21	1	28'-6"	19	4b1		
4b2	Wingwall, B.F.H, Short		1	40'-4"	29	1	37'-4"	25	1	34'-4"	23	1	31'-4"	21	1	28'-4"	19	1	25'-4"	17	4b2		
4b3	Wingwall, B.F.H, Long		10 Var.	13'-2 to 44'-0	194	9 Var.	13'-2 to 40'-7	163	8 Var.	13'-2 to 37'-2	134	7 Var.	13'-2 to 33'-9	110	6 Var.	13'-2 to 30'-4	87	5 Var.	13'-2 to 26'-11	67	4b3		
4b4	Wingwall, B.F.H, Short		10 Var.	11'-11 to 38'-11	170	9 Var.	11'-11 to 35'-11	144	8 Var.	11'-11 to 32'-11	120	7 Var.	11'-11 to 29'-11	98	6 Var.	11'-11 to 26'-11	78	5 Var.	11'-11 to 23'-11	60	4b4		
5b5	Wingwall, F.F.H, Long		1	45'-8"	50	1	42'-3"	47	1	38'-10"	41	1	35'-5"	37	1	31'-11"	33	1	28'-6"	30	5b5		
5b6	Wingwall, F.F.H, Short		1	40'-4"	45	1	37'-4"	39	1	34'-4"	36	1	31'-4"	33	1	28'-4"	30	1	25'-4"	26	5b6		
5b7	Wingwall, F.F.H, Long		11 Var.	9'-0 to 44'-1	314	10 Var.	9'-0 to 40'-8	266	9 Var.	9'-0 to 37'-3	221	8 Var.	9'-0 to 33'-10	182	7 Var.	9'-0 to 30'-5	147	6 Var.	9'-0 to 26'-11	115	5b7		
5b8	Wingwall, F.F.H, Short		11 Var.	9'-0 to 39'-0	275	10 Var.	9'-0 to 36'-0	235	9 Var.	9'-0 to 33'-0	197	8 Var.	9'-0 to 30'-0	163	7 Var.	9'-0 to 27'-0	131	6 Var.	9'-0 to 24'-0	103	5b8		
4c1	Wingwall, F.F.V, Long		42 Var.	2'-9 to 14'-9	245	39 Var.	2'-9 to 13'-10	216	35 Var.	2'-9 to 12'-8	180	32 Var.	2'-9 to 11'-10	156	29 Var.	2'-9 to 10'-11	132	25 Var.	2'-9 to 9'-9	104	4c1		
4c2	Wingwall, F.F.V, Short		37 Var.	2'-9 to 14'-9	216	34 Var.	2'-9 to 13'-9	187	31 Var.	2'-9 to 12'-9	160	28 Var.	2'-9 to 11'-9	136	25 Var.	2'-9 to 10'-9	113	22 Var.	2'-9 to 9'-9	92	4c2		
4c3	Wingwall, F.F.V, Long		19 Var.	9'-7 to 14'-10	155	16 Var.	9'-7 to 14'-0	126	12 Var.	9'-7 to 12'-10	90	9 Var.	9'-7 to 11'-11	65	--	--	--	--	--	--	4c3		
4c4	Wingwall, F.F.V, Short		17 Var.	9'-7 to 14'-11	139	14 Var.	9'-7 to 13'-11	110	11 Var.	9'-7 to 12'-11	83	8 Var.	9'-7 to 11'-11	57	--	--	--	--	--	--	4c4		
4c5	Wingwall, F.F.V, Long		2	13'-8"	18	2	12'-8"	17	2	11'-8"	16	2	10'-8"	14	2	9'-8"	6	2	8'-8"	12	4c5		
4c5	Wingwall, F.F.V, Short		2	13'-8"	18	2	12'-8"	17	2	11'-8"	16	2	10'-8"	14	2	9'-8"	6	2	8'-8"	12	4c5		
5c6	Wingwall, B.F.V, Long		9 Var.	2'-9 to 5'-1	37	9 Var.	2'-9 to 5'-1	37	9 Var.	2'-9 to 5'-1	37	9 Var.	2'-9 to 5'-1	37	9 Var.	2'-9 to 5'-1	37	9 Var.	2'-9 to 5'-1	37	5c6		
5c7	Wingwall, B.F.V, Short		6 Var.	2'-9 to 4'-5	22	6 Var.	2'-9 to 4'-5	22	6 Var.	2'-9 to 4'-5	22	6 Var.	2'-9 to 4'-5	22	6 Var.	2'-9 to 4'-5	22	6 Var.	2'-9 to 4'-5	22	5c7		
6c9	Wingwall, B.F.V, Long		33 Var.	9'-5 to 18'-9	698	30 Var.	9'-5 to 17'-10	614	26 Var.	9'-5 to 16'-8	509	23 Var.	9'-5 to 15'-10	436	20 Var.	9'-5 to 14'-11	365	16 Var.	9'-5 to 13'-9	278	6c9		
6c9	Wingwall, B.F.V, Short		31 Var.	8'-9 to 18'-9	640	28 Var.	8'-9 to 17'-9	557	25 Var.	8'-9 to 16'-9	479	22 Var.	8'-9 to 15'-9	405	19 Var.	8'-9 to 14'-9	335	16 Var.	8'-9 to 13'-9	270	6c9		
6c10	Wingwall, B.F.V, Long		25	10'-6"	394	22	10'-6"	347	18	10'-6"	284	15	10'-6"	237	12	10'-6"	189	8	10'-6"	126	6c10		
6c10	Wingwall, B.F.V, Short		22	10'-6"	347	19	10'-6"	300	16	10'-6"	252	13	10'-6"	205	10	10'-6"	158	7	10'-6"	110	6c10		
6c11	Wingwall, B.F.V, Long		2	17'-8"	53	1	16'-8"	35	2	15'-8"	47	2	14'-8"	44	1	13'-8"	21	2	12'-8"	38	6c11		
6c11	Wingwall, B.F.V, Short		2	17'-8"	53	2	16'-8"	50	2	15'-8"	47	2	14'-8"	44	2	13'-8"	41	2	12'-8"	38	6c11		
4d1	Apron, Longit., Bott.		7	28'-10"	135	7	26'-9"	125	7	24'-9"	116	7	22'-8"	106	7	20'-7"	96	7	18'-6"	87	4d1		
4d2	Apron, Longit., Bott, Long		3	40'-3"	86	3	36'-10"	74	3	33'-5"	67	3	26'-7"	60	3	26'-7"	53	3	23'-1"	40	4d2		
4d3	Apron, Longit., Bott, Short		3	35'-6"	71	3	32'-5"	65	3	29'-5"	59	3	26'-5"	53	3	23'-5"	47	3	20'-5"	41	4d3		
6f1	Apron, Longit., Top		9	28'-10"	390	9	26'-9"	362	9	24'-9"	335	9	22'-8"	306	9	20'-7"	278	9	18'-6"	250	6f1		
6f2	Apron, Longit., Top Long		9 Var.	5'-5 to 25'-7	210	8 Var.	5'-10 to 23'-6	176	7 Var.	6'-3 to 21'-5	145	6 Var.	6'-8 to 19'-5	118	5 Var.	7'-2 to 17'-4	92	4 Var.	7'-7 to 15'-3	69	6f2		
6f3	Apron, Longit., Top Short		8 Var.	5'-5 to 25'-8	187	7 Var.	6'-3 to 23'-8	157	6 Var.	7'-0 to 21'-7	129	6 Var.	4'-11 to 19'-6	110	5 Var.	5'-9 to 17'-5	87	4 Var.	6'-7 to 15'-4	66	6f3		
6f4	Apron, Longit., Top Long		1	45'-8"	72	1	42'-3"	67	1	38'-10"	58	1	35'-5"	53	1	31'-11"	48	1	28'-6"	43	6f4		
6f5	Apron, Longit., Top Short		1	40'-4"	64	1	37'-4"	56	1	34'-4"	52	1	31'-4"	47	1	28'-4"	43	1	25'-4"	38	6f5		
4i1	Parapet, Vertical		21	6'-2"	87	21	6'-2"	87	21	6'-2"	87	21	6'-2"	87	21	6'-2"	87	21	6'-2"	87	4i1		
7j1	Parapet, Horizontal		4	12'-0"	98	4	11'-10"	97	4	11'-8"	95	4	11'-8"	95	4	11'-8"	95	4	11'-6"	94	7j1		
6m1	Apron, Trans., Top		3 Var.	12'-4 to 12'-8	56	3 Var.	12'-2 to 12'-6	56	3 Var.	12'-0 to 12'-4	55	3 Var.	12'-0 to 12'-4	55	3 Var.	12'-0 to 12'-4	55	3 Var.	11'-10 to 12'-2	54	6m1		
6m2	Apron, Trans., Top		31 Var.	13'-0 to 24'-3	867	28 Var.	12'-10 to 22'-11	752	25 Var.	12'-7 to 21'-7	641	22 Var.	12'-7 to 20'-6	547	19 Var.	12'-7 to 19'-4	455	17 Var.	12'-5 to 18'-5	394	6m2		
6m3	Apron, Trans., Top		3 Var.	8'-10 to 14'-1	52	3 Var.	8'-10 to 14'-1	52	4 Var.	6'-3 to 14'-1	61	4 Var.	6'-4 to 14'-2	62	4 Var.	6'-5 to 14'-6	62	3 Var.	6'-6 to 11'-9	41	6m3		
6m4	Apron, Trans., Bott.		24 Var.	5'-11 to 18'-4	437	22 Var.	5'-11 to 17'-3	383	20 Var.	5'-11 to 16'-2	332	18 Var.	5'-11 to 15'-1	284	16 Var.	5'-11 to 14'-0	239	14 Var.	5'-11 to 12'-11	198	6m4		
6p1	Curtain, Horizontal		4	10'-7"	64	4	10'-7"	64	4	10'-7"	64	4	10'-7"	64	4	10'-7"	64	4	10'-7"	64	6p1		
6p2	Curtain, Horizontal, Long		4	12'-9"	131	4	20'-3"	122	4	18'-9"	113	4	17'-3"	104	4	15'-9"	95	4	14'-2"	85	6p2		
6p3	Curtain, Horizontal, Short		4	16'-10"	101	4	15'-9"	95	4	14'-7"	88	4	13'-6"	81	4	12'-5"	75	4	11'-3"	68	6p3		
6s1	Wing Slope, Both F., Long		2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	2	6'-11"	21	6s1		
6s2	Wing Slope, Both F., Short		2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	2	6'-6"	20	6s2		
6s3	Wing Slope, Both F., Long		2	4'-1'-3"	131	2	3'-7"	113	2	3'-4"	103	2	3'-0"	92	2	2'-7"	81	2	2'-3"	70	6s3		
6s4	Wing Slope, Both F., Short		2	36'-11"	111	2	33'-9"	101	2	30'-7"	92	2	27'-5"	82	2	24'-3"	73	2	21'-1"	63	6s4		
6s5	Wing Slope, F.F, Long		1	46'-5"	73	1	42'-10"	68	1	39'-3"	59	1	35'-8"	54	1	32'-1"	48	1	28'-7"	43	6s5		
6s6	Wing Slope, F.F, Short		1	41'-8"	66	1	38'-6"	58	1	35'-4"	53	1	32'-2"	48	1	29'-0"	44	1	25'-10"	39	6s6		
5t1	Curtain, Vertical		28	7'-11"	186	21	7'-8"	208	24	7'-5"	186	23	7'-2"	172	21	6'-11"	151	18	6'-8"	125	5t1		
Estimated Quantities One Headwall			Reinf. Steel			7911 LB			6950 LB			6057 LB			5267 LB			4393 LB			3688 LB		
			Parapet Δ			1.7			1.6			1.5			1.5			1.5			1.5		
			Concrete			23.0			18.1			13.9			11.6			9.5			6.8		
			Wingwalls			62.2 CY			52.6 CY			44.0 CY			37.9 CY			32.3 CY			26.1 CY		
			Apron *			37.5			32.9			28.6			24.8			21.3			17.8		

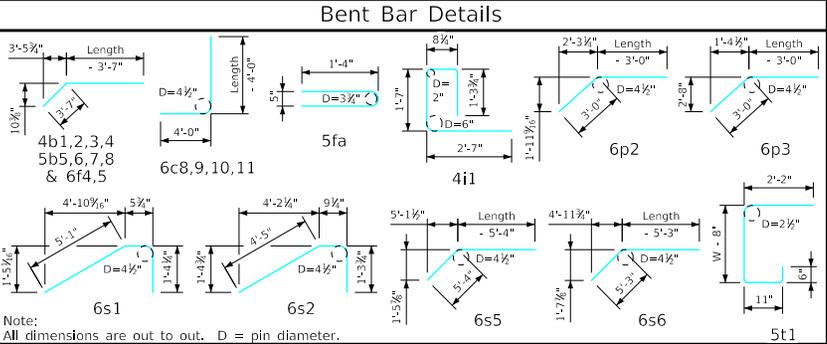
Δ Includes top of wingwall quantities.
 * Assumes apron and floor are equal thickness, adjust concrete quantities for transition where apron and floor thickness are not equal.

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Lengths shown for bars over 40'-0" long do not include lap.

"Short" Denotes Short Wingwall
 "Long" Denotes Long Wingwall

Headwall Notes:

- See Sheet FWH G2-21 for General Notes, Specifications, and Design Stresses.
- This headwall is based on a 3:1 slope normal to centerline of roadway.
- The sides of the apron are to be formed to ensure correct line and grade.
- All apron reinforcing steel is to be supported by bar chairs at intervals of not more than 3'-0" in either direction as outlined in the Standard Specifications.
- Clear distance from face of concrete to near reinforcing bar is to be 2" unless otherwise noted or shown. Clearance to the bottom ends of vertical bars shall be 3 inches.
- Concrete quantities are estimated from back of parapet.
- Horizontal tails of bars "b1" and "5" estimated to extend 2'-5" beyond back of parapet into end of barrel. Longitudinal bars "d", "6f1", "6f4" and "6f5" estimated to project into end section of barrel a minimum of 2'-5" beyond back of parapet. The "length" column reflects total number of feet necessary to meet these requirements.
- Dimensions are in feet and inches unless otherwise noted.



LATEST REVISION DATE APPROVED BY BRIDGE ENGINEER 	
	Standard Design - Single Reinforced Concrete Box Culverts Flared Wing Headwalls February, 2021
	Quantity Tabulation 10'-0" Span 15° Skew
	FWH 15-9-21 Sheet 1 of 2